Reference

411

Thermophilic co-digestion of organic fraction of municipal solid wastes with FOG wastes from a sewage treatment plant: reactor performance and microbial community monitoring

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Keywords: anaerobic co-digestion, municipal solid wastes, fat wastes, microbial community, 16S rRNA gene

Abstract

Anaerobic digestion is widely applied to treat the organic fraction of municipal solid wastes (OFMSW). Sewage treatment plant fat/oil and grease wastes (STP-FOGW) have a high theoretical methane potential, a fact that makes them suitable as co-substrate for anaerobic digestion process. Co-digestion of both wastes could be a feasible treatment that would enable valorization of STP-FOGW and also obtain a higher methane yield in the whole anaerobic digestion process. In this work, the performance of a 5l continuous lab-scale reactor was evaluated in two operation periods: when fed only with OFMSW (Period 1) and with a mixture of OFMSW and STP-FOGW at a volatile solids (VS) co-digestion ratio of 6:1 (Period 2). Reactor performance was evaluated in terms of VS reduction, biogas production, methane content in biogas, volatile fatty acids (VFA) and long-chain fatty acids (LCFA) content. In addition, sludge samples were collect in both periods and the microbial structure analyzed through PCR-DGGE of the 16S rRNA gene fragments and cloning/sequencing techniques.

During Period 1 methane yield average value was 0.36 (m3 CH4/ kg VS added) and TS and VS reduction were around 60 and 70%, respectively. As a result of STP-FOGW addition, an enhancement in methane yield was noticed in Period 2, reaching an average value of 0.51 m3 CH4/kg VS added. VS and TS efficiency were not affected by the STP-FOGW addition.

DGGE-fingerprints analyses showed that bacterial community was more affected by the STP-FOGW addition than the archaeal one. The obtained bacterial profiles clustered in two distinct groups, before and after the extended presence of STP-FOGW.

Stable reactor performance was observed during the whole experiment revealing that co-digestion of OFMSW with STP-FW is a feasible treatment option for both wastes.